NATURE | NEWS

How the disco clam got its flash

Nanobeads of reflective silica give mollusc its glow.

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25 June 2014

Disco clam
The disco clam (*Ctenoides ales*) has an array of reflective silica nanobeads that create its characteristic luminescence — and which it can control to create the effect of rapid flashing.

As molluscs go, *Ctenoides ales* is quite literally one of the flashiest. A native of the Indo-Pacific region, the creature is known as the disco clam because the soft tissues of its 'lips' flash like a mirror ball above a dance floor. A study published today finds that the disco clam achieves this using nanoparticles of silica to reflect light.

This kind of control is a feat that is apparently unique in nature. "We don't know of anything that is quite like the disco clam," says Lindsey Dougherty, a biologist at the University of California, Berkeley, who led the work, published today in the *Journal of the Royal Society Interface*[1].

The clam's flashes were once thought to be bioluminescence, a result of light-emitting chemical reactions such as those that give fireflies and deep-sea fish their glow. Scientists now know that the display is due entirely to reflected light. Dougherty and her colleagues show that the reflections are caused by spheres of silica — chemically similar to window glass — synthesized by the clam and sequestered on one side of its mantle lips, the soft folds that the clam uses for feeding. The other side of the lip, in contrast, absorbs light and appears a reddish colour.

The flashing occurs as the mollusc rolls up and unfurls each side in concert, several times a second.

"To my knowledge, this reflectance from micro-silica in this critter, with a muscle-driven 'shutter' that creates rapid blinking, is unique," says Daniel Morse, a molecular biologist at the University of California, Santa Barbara.

Many animals have 'photonic' structures that reflect and scatter light, and these often are orderly arrays of light-scattering objects with sizes of several hundred nanometres, comparable to the wavelengths of visible light. Stacked plates of dense tissue are responsible

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A disco clam in the Pacific Ocean waters off the Solomon Islands.

and bird feathers. In squid, the spacing between these plates can change to reflect different colours.

It is unusual for such structures to reflect the whole visible spectrum, as in *C. ales*, so as to appear white. Some beetles make their white cuticle this way[2], and some butterflies have white wing scales studded with reflective beads[3].

The disco clam is also one of only a few organisms that use silica as the reflector. Some marine single-cell algae called diatoms have silica cell walls containing photonic structures, but these do not reflect the full visible spectrum[4]. *Pachyrhynchus argus*, a type of weevil, also uses silica bead arrays[5]. In the disco clam, the spheres have a narrow size distribution centred at a diameter of about 300 nanometres. Dougherty and her colleagues calculate that this makes them ideally suited for reflecting the blue-green light (wavelengths of 400–500 nm) that predominates in the mollusc's marine habitat.

The researchers do not yet know what purpose the disco clam's photonics serve. They have found that the flashing rate increases in tests that mimic the looming of a predator, suggesting that the display serves to ward off such threats. But Dougherty says that it could also be a spawning signal or a lure for the plankton on which the clams feed.

Whatever its purpose, it could be a trick worth learning. Other 'animal photonics' have inspired engineers seeking new ways to manipulate light[6], and *C. ales* might do the same. Dougherty is particularly impressed with how well the reflectors work in low light. "There could be biomimicry potential in low-light situations or in environments that are dominated by blue-green wavelengths," for instance underwater, she says.

Nature | doi:10.1038/nature.2014.15462

References

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